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FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

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OFFICE OF SECRETARY

In the Matter of

Advanced Television Systems and
Their Impact Upon Existing Television
Broadcast Service

MM Docket No. 87-268

REPLY COMMENTS OF MOTOROLA

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Motorola hereby submits these replies to comments filed in response to the *Sixth Further Notice of Proposed Rule Making* in the above captioned proceeding.¹ Upon review of the record, Motorola reaffirms the need to design the deployment of digital television services ("DTV") in a spectrally efficient manner that enables the recovery of television spectrum for alternative purposes. Specifically, by avoiding the placement of DTV allotments in UHF-TV channels 60-69, the Commission can provide broadcasters with a credible path for implementing DTV and, at the same time, immediately allow additional mobile users, such as public safety, to use channels 60-69 across significant portions of the United States. Motorola therefore urges the FCC to fully consider the technical proposals submitted by Motorola to improve the efficiency of the Commission's DTV allotment plan.

¹ *Sixth Further Notice of Proposed Rule Making*, MM Docket No. 87-268, FCC 96-317, released August 14, 1996 [hereinafter *Sixth Further Notice*].

I. INTRODUCTION AND SUMMARY

Throughout the nearly 10 year history of this proceeding, the FCC has considered the technical, political and societal issues involved in this nation's transition to new digital technologies for the broadcast television service. When appropriate, Motorola has participated in this debate largely to provide input and analysis on efficient spectrum management and to remind the Commission of the importance of this proceeding to the future of the private land mobile services. As has been documented many times, in most major cities there is no spectrum remaining for new public safety, industrial and business private wireless systems or to even maintain a reasonable communications quality level for existing users.² At the same time, however, the broadcast television service only utilizes about 30 percent of its total allocation of 400 MHz largely due an allotment plan based on inefficient 40-year old NTSC technology. Clearly, proper spectrum management requires that this situation be addressed, particularly given the variety of alternative distribution channels now available for video news and entertainment.

Therefore, Motorola supports the Commission's efforts to encourage more efficient use of the broadcast spectrum by proposing an allotment plan that will facilitate

² See e.g., *US National Spectrum Requirements, Projections and Trends*, NTIA Special Publication 94-31, March 1995, at 5 [predicting that non-public safety land mobile dispatch operations will experience a spectrum shortfall of 18 MHz in the 1997/1998 timeframe]. See also, Petition for Rulemaking, Dec. 23, 1993, The Coalition of Private Users of Emerging Technologies. See also, *Public Safety Wireless Advisory Committee Final Report*, WT Docket No. 96-86, September 1996 [*hereinafter PSWAC Final Report*].

the repacking of all digital television stations to a core allocation that is smaller than today's over-abundant allocation.³ In particular, Motorola strongly supports the FCC's proposal to facilitate an immediate reallocation of spectrum by minimizing the number of DTV allotments in UHF-TV channels 60-69. As noted by Motorola and other opening round commenters, this approach is an ideal solution to addressing the severe shortages now facing the private land mobile services, particularly the public safety services.

To facilitate this action, Motorola has performed analysis using the FCC's methodology to create a DTV allotment plan that further reduces the number of DTV allotments in UHF channels 60-69. Motorola's successful efforts result in 5 DTV allotments in those channels compared to the 30 allotments shown in the FCC's plan. This reduction is possible *without decreasing any protection criteria for the broadcast stations*.

Reducing the number of new allotments in TV channels 60-69 offers a "win/win/win" solution for broadcasters, land mobile users, and the public interest. First, Motorola's analysis demonstrates that broadcasters will be able to proceed with DTV deployment without service impairment. Second, by avoiding DTV allotments on channels that can be reallocated for other purposes, the Commission will eliminate a costly two-step relocation process upon affected broadcasters. Third, as reflected by many broadcasters in opening comments, the upper UHF band is not a desirable spectrum home for television stations from a technical, cost and marketing perspective.

³ *Sixth Further Notice* at ¶19.

Land mobile interests would obviously benefit from an influx of new spectrum and such benefits can be realized in the near term without waiting the 15 years that broadcast interests recommend as a transition period. In these reply comments, Motorola demonstrates that significant spectrum would be made available immediately for land mobile use with full protection to existing NTSC service throughout major portions of the U.S. For example, maps showing the required co-channel protection necessary for NTSC stations on channels 60 and 65 depict that cities such as Chicago, Houston, Los Angeles, Dallas, and Miami would have spectrum available. The subsequent migration of NTSC stations now operating in channels 60-69 to more desirable broadcast channels as part of the DTV transition would of course free up the entire spectrum for nationwide use.

Motorola urges the FCC to pursue its plan to create spectrum for alternative uses at the same time it encourages the transition to DTV. In addition, Motorola reminds the FCC that it must protect existing land mobile use of channels 14-20 in our largest cities. To characterize this spectrum use as "lightly loaded" as done by broadcast interests is wrong and demeaning to the users providing a myriad of critical services within this spectrum. Thousands of public safety, industrial and business users are dependent upon this spectrum and its loss would have a devastating impact on this nation's economy and well being. Motorola urges the FCC to maintain appropriate interference protection for these operations.

II. THE IMMEDIATE RECOVERY OF UHF-TV CHANNELS 60-69 WILL PROVIDE CRITICAL SPECTRUM FOR LAND MOBILE USE WITHOUT HINDERING DTV DEPLOYMENT

In its opening comments, Motorola strongly supported the FCC's core allocation proposal ultimately to confine DTV stations to channels 7-59 as a means to provide spectrum for alternative uses. Motorola noted that the continuing efforts of the land mobile industries to utilize more spectrally efficient technologies has not kept pace with demand for new and improved services leaving many major markets spectrum deficient for many mobile operations.⁴ In addition, Motorola pointed out the recommendations the Public Safety Wireless Advisory Committee ("PSWAC") to the FCC and the NTIA that, in the immediate near term, public safety users need 25 MHz of spectrum to offset critical shortages. In the face of this need, Motorola stated that it "cannot identify any alternative spectrum that would provide the near term benefits that [UHF-TV channels 60-69] offers."⁵

Motorola's support for recovery of broadcast television spectrum was echoed by other land mobile interests. Representing the public safety users, APCO stated that "[t]he UHF spectrum now reserved for television channels 60-69 is particularly well-suited for many of the public safety spectrum needs identified by PSWAC."⁶ APCO's optimism is

⁴ Comments of Motorola at 5-6.

⁵ Id. at 8.

⁶ Comments of the Association of Public-Safety Communications Officials-International (APCO) at 6.

based largely on the relatively small number of NTSC stations operating on channels 60-69 and that the band's proximity to existing public safety spectrum would "greatly enhance interoperability between current and future public safety radio systems operating in the 800 MHz bands."⁷ APCO's recommendation that the FCC make available at least 24 MHz from channels 60-69 for use by public safety was reinforced by numerous other public safety interests filing on their own motion including the New York Police Department, Mount Laurel (NJ) Township Police, and the County of Los Angeles.⁸

Representing a broader cross section of the land mobile wireless interests, the Land Mobile Communications Council ("LMCC") also indicated its strong support for the core allocation proposal and the reallocation of UHF-TV channels 60-69. Noting that additional allocation proceedings would be necessary before finalizing ultimate use of recovered spectrum, LMCC theorized that the spectrum now occupied by channels 60-69 could be "... licensed through competitive bidding for flexible mobile operations, a portion could be used to meet public safety needs, and a portion could be designated temporarily

⁷ Id. at 6-7.

⁸ APCO also recommends that the FCC fully consider recovery of UHF-TV channels 7 and 8 as well as developing further land mobile sharing opportunities in channels 14-20. Comments of APCO at 15. Motorola agrees with APCO that public safety agencies will require spectrum in addition to any new allocations received from the recovery of channels 60-69. This is consistent with the recommendations of the PSWAC Final Report that Motorola fully supports. However, Motorola believes that the initial focus should remain on recovery of channels 60-69 because the relative lack of incumbency makes it the prime option for near term use by land mobile users. Reexamination of further sharing opportunities at 470-512 MHz should occur subsequent to the DTV allotment resolution.

or permanently for LPTV and TV translator stations."⁹ LMCC agrees with Motorola and APCO that the FCC is being provided with "the opportunity to repeat" the success of the previous 800 MHz land mobile allocations that led to the creation of the cellular radio service, the specialized mobile radio service, air phone service, and spectrum for public safety agencies.¹⁰

As expected, the broadcast industry presents a different perspective on the core allocation proposal and the general proposition of recovering broadcast spectrum for other purposes. The views of many major broadcast interests, including the National Association of Broadcasters, Maximum Service Telecasters, the major networks and group owners, are represented in a coalition pleading that argues that the core allocation proposal: 1) creates unacceptable full power and low power television service losses, 2) reduces necessary flexibility in rolling out DTV, 3) prejudices the optimality of different frequency bands for DTV, and 4) endorses an early recovery of spectrum where the benefits are speculative and uncertain.¹¹

Motorola finds these arguments self-serving and recommends that the FCC reject the modified table as submitted by the Broadcast Coalition. As further discussed in the attached Appendix, the modified allotment plan offers little, if any, improvement in terms

⁹ Comments of the land Mobile Communications Council at 7-8.

¹⁰ Id. at 7.

¹¹ Broadcasters Comments on the Sixth Further Notice of Proposed Rule Making at 25-42 [*hereinafter* referred to as the comments of the Broadcast Coalition].

of minimizing any service area loss to broadcasters even though it places an inordinate number of DTV allotments in TV channels 60-69. Motorola is skeptical that individual broadcasters would find this to be a “win/win” solution given that it provides so many allotments in spectrum traditionally found undesirable by broadcasters due to the propagation penalties and increased power requirements.

To demonstrate the affect of the broadcaster’s modified allotment table, attached to these comments are two charts, one comparing Motorola’s proposed allotment table with the FCC’s and the other comparing the Broadcast Coalition’s proposal with the FCC’s. Using the FCC’s table as a baseline, the charts show the variance of the proposals in terms of the number of DTV allotments per channel. For example, the first chart shows that Motorola’s plan contains 4 more allotments on channel 39 than the FCC’s plan and 4 fewer allotments on channel 60 than the FCC’s table. Graphically, Motorola’s enhancement of the FCC’s proposal represents an even distribution across the television spectrum. The second chart, however, clearly demonstrates the packing of Channels 60-69 by the Broadcast Coalition’s proposed table. In so doing, the Broadcast Coalition's modified table greatly impacts the usefulness of early recovery of Channels 60-69.

However, this increase in DTV allotments in channels 60-69 does not improve the spectrum environment for broadcasters during the transition to DTV service. As discussed in the attached Appendix, the modified table submitted by the broadcasters provides insignificant improvements in loss of service area compared to both the FCC's proposed plan and Motorola's submission. The FCC's proposed table results in an

average reduction in the service area of an NTSC station of 1.4% due to theoretical interference from new DTV allotments when properly considering the effects of terrain shielding.¹² Motorola's proposed solution calculated to an average reduction of 1.6% for the same interference phenomenon. Finally, the modified table of the Broadcast Coalition results in a 1.5% reduction. In Motorola's view, the performance of the broadcaster's preferred allotment table is insignificantly different considering that its cost precludes the possibility of early recovery of channels 60-69. Motorola's proposal, on the other hand, results in 5 channels between 60-69 that do not have any DTV allotments and only 5 allotments spread out across the remaining 5 channels.

In this regard, Motorola notes that the Broadcast Coalition dismisses the benefits of early recovery of channels 60-69, arguing that the "proposed early auction" of segments of channels 60-69 would earn far less than a much later auction of contiguous spectrum.¹³ The Coalition also provides maps purporting to show that little spectrum would be available assuming protection of the existing 97 NTSC facilities and whatever DTV assignments are made. The coalition states spectrum available would be found in "rural Montana, where a sixth PCS provider is not particularly needed."¹⁴ Finally, the

¹² Longley-Rice propagation/terrain analysis was utilized to avoid concluding that a loss of service area occurs at locations that are shadowed from the desired broadcast station. In other words, it would be inappropriate to consider theoretical interference caused by new DTV stations to areas that, in reality, do not receive service from the desired NTSC station.

¹³ Comments of the Broadcast Coalition at 41.

¹⁴ *Id.* at 41-42.

Coalition provides an economic analysis suggesting that the government could earn 2.3 - 10.6 times more revenue if it would wait 15 years before auctioning off contiguous blocks of spectrum from channels 60-69.

Motorola believes that the Broadcast Coalition's analysis is fatally influenced by the bias of its supporters. First, it is noteworthy that the coalition focuses solely on auctioning this spectrum for commercial mobile radio services and ignores the public benefits of allocating portions of this spectrum for public safety organizations. As Motorola and other commenters have argued, the first priority for the early recovery of Channels 60-69 is to accommodate the needs of the public safety community as represented by the PSWAC report. It is improper to compare the benefits of a public safety allocation with the amount of revenue that can be generated by a spectrum auction.

Second, Motorola questions the validity of any economic analysis that attempts to determine the value of spectrum 15 years in the future. Clearly, technological and business environments can drastically change over that period of time to significantly affect spectrum applications and value. Improvements in spectrum efficient technologies may affect spectrum value. New sources of spectrum could come from the Federal government reserves thus affecting "supply and demand". And, while it is clear that spectrum will continue to be needed for mobility, it is not clear that over a 15 year time frame, Americans will continue to need over-the-air broadcasting for their video entertainment and news.¹⁵ All of these events can drastically alter the value of spectrum

¹⁵ Already, more than 90 percent of American television households have the
(Continued...)

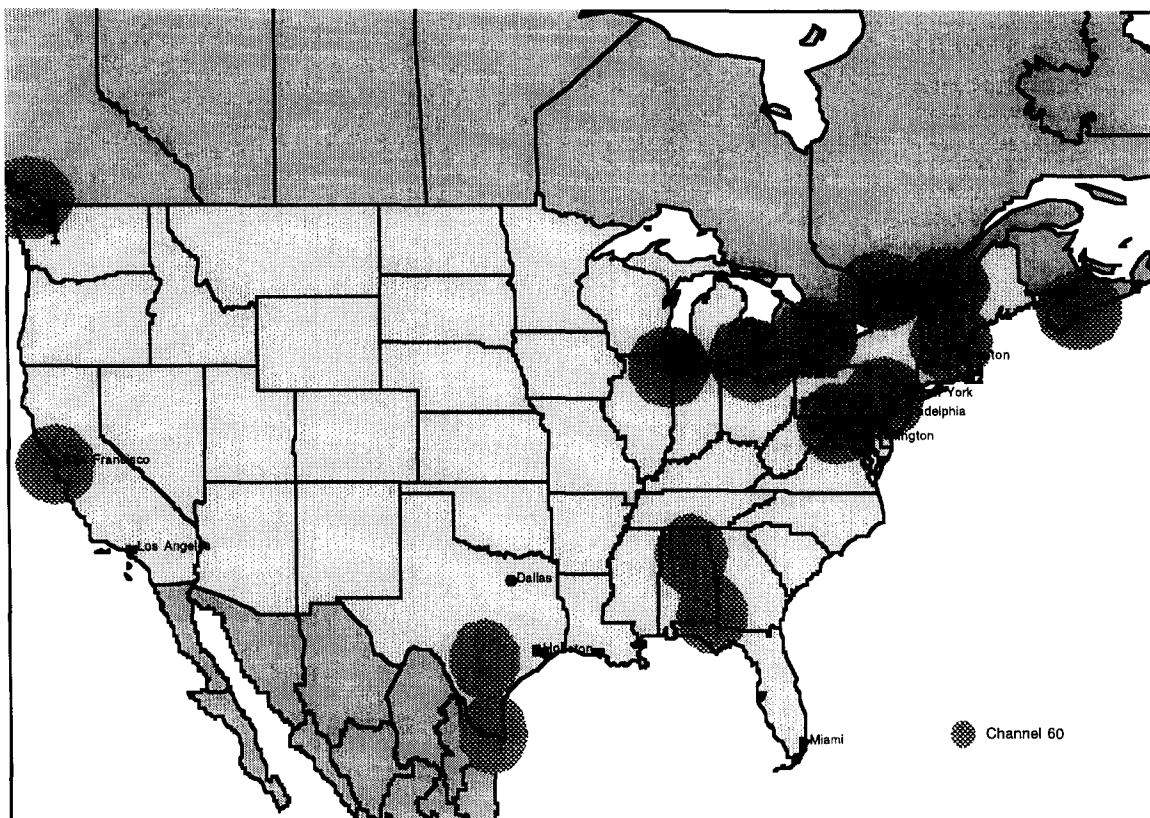
over the next 15 years and render the economic analysis provided by the Coalition as meaningless.

Third, and most important, the suggestions that minimal spectrum would be available during the DTV transition period is wrong. The following maps are based on Motorola's proposed allotment table and reflect the co-channel protection zones for existing NTSC service on channels 60 and 65.¹⁶ Under Motorola's proposed table, neither of these channels is assigned a DTV allotment. As can be seen, the majority of the country would be available for alternative spectrum use on both these channels.

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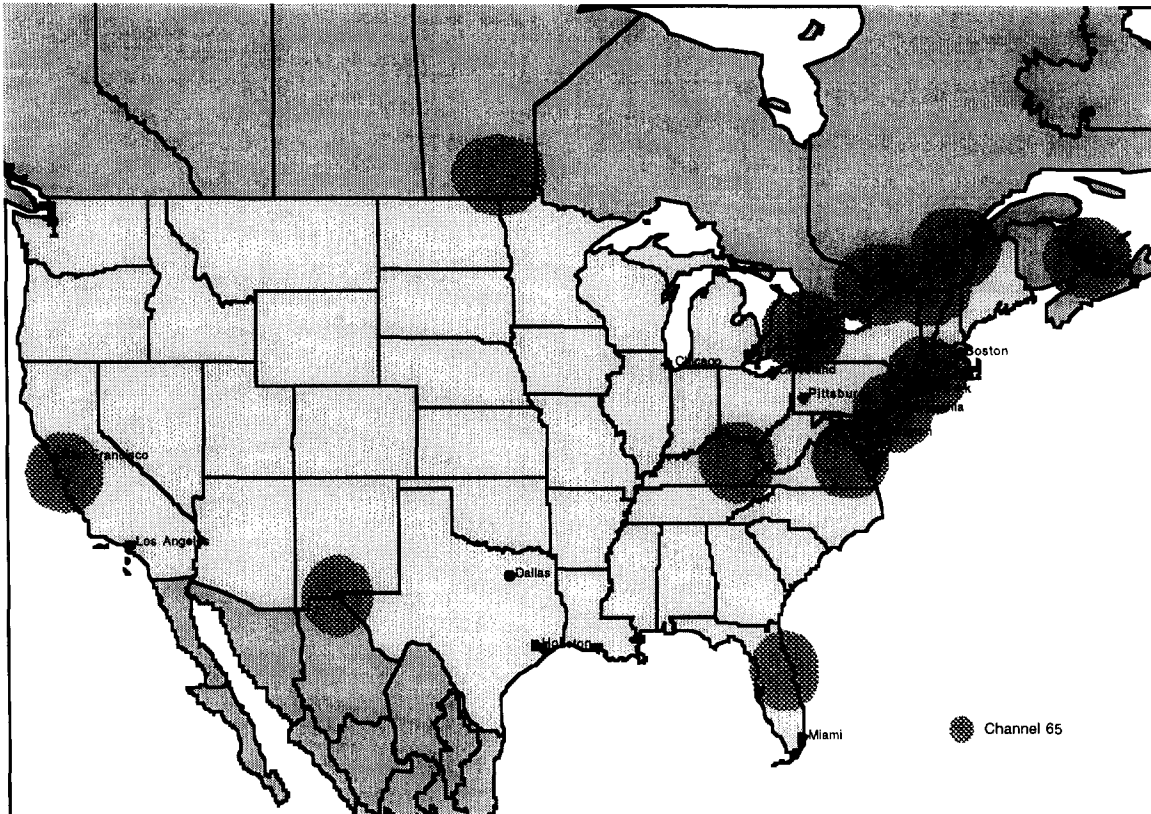
option of receiving television service over cable. In addition, broadcast networks are offering delivery of programming over the internet. Improvements in cable system technologies recently developed offer possibilities of faster internet delivery, potentially making this option even more appealing in the future.

¹⁶ The circle on the maps represent exclusion zones calculated using the rules developed for the 470-512 MHz band. due to propagation differences in the 746-806 MHz band, Motorola estimates using the R-6602 curves, that exclusion zone circles can be reduced by 10 miles, from 162 to 152 miles. Furthermore, improvements in the selectivity of television receivers indicates that 50 dB protection, as used in most cities today, may not be necessary. With 40 dB of protection, which is presently used in New York City on channel 15, and incorporating the 746-806 MHz band propagation adjustment, the exclusion zones could be reduced further to a radius of 120 miles as compared to 162 miles.



As can clearly be seen from the channel 60 map, cities such as Los Angeles, Dallas, Houston, and Miami would have no co-channel difficulties at all. Even Pittsburgh would fall within the sharing guidelines over most of the greater metropolitan area

Similarly, the results for channel 65, another channel for which Motorola proposes no DTV allocations are shown below.



As shown, Chicago, Los Angeles, Dallas, Houston, Miami, Cleveland, Detroit, Boston, and Pittsburgh, all lie outside the maximum protection region for co-channel NTSC stations. Clearly, the benefits extend beyond “rural Montana” and can be further realized, if the existing NTSC stations are encouraged to vacate the upper UHF channel assignments. Therefore, Motorola suggests that the FCC allow UHF NTSC stations to use their DTV allotment for NTSC service during the transition period provided that the existing television assignment standards are maintained. In any event, the FCC should remain open to reviewing any number of potential solutions to incumbent relocation that are negotiated by all parties involved.

Motorola continues to believe that all aspects of the public interest are best served through a thorough refarming of the broadcast television allocation that provides spectrum immediately for needed services. Motorola's proposed allotment plan provides each existing NTSC station with a second 6 MHz channel with all but five located below channel 60. When compared to the allotment table favored by the Broadcast Coalition, the reduction in theoretical service areas is effectively insignificant. By proceeding with the core allocation proposal, the FCC maintains its options to more effectively manage the radio spectrum.

IV. THE FCC MUST PROTECT EXISTING LAND MOBILE USE

In its opening round comments, Motorola discussed the potential interference to land mobile stations operating on UHF-TV channels 14-20 in 11 major markets caused by adjacent channel DTV stations.¹⁷ Motorola noted that the FCC's proposed allotment plan contained 13 cases where the proposed DTV allotment was "short-spaced" to the adjacent channel land mobile operations (*i.e.*, less than 10 miles). Motorola then attempted to find more appropriate DTV allotments that better protect adjacent channel land mobile operations but at least 10 short-spacing situations remained.¹⁸ Motorola therefore recommended that the Commission require that DTV stations in close proximity to adjacent land mobile operations attenuate out-of-band emissions by at least another 30

¹⁷ Comments of Motorola at 7.

¹⁸ *Id.* at Appendix A, p.4.

dB to minimize adjacent channel interference but that even this level of relief will be insufficient to address the most egregious, i.e., less than 10 miles, short spacing situations.¹⁹

In a related matter, Motorola indicated its strong opposition to the reallocation of UHF-TV channel 20 in Philadelphia from the land mobile services to DTV service noting that over 16,000 mobile units are currently utilizing this spectrum and that it is inconceivable that the FCC and the broadcast industry would even discuss evicting these users without alternative spectrum and relocation policies being identified.²⁰

Many of the commenting parties addressed this issue. Land mobile interests such as UTC and the LMCC urge the FCC to ensure protection to existing important land mobile operations at 470-512 MHz.²¹ LMCC, for example, refers to the FCC's records showing that over 40,000 base and fixed stations are authorized in this band serving more than 400,000 mobile units and that the FCC's proposed separations are "inadequate to prevent interference to land mobile stations."

The Association of Federal Communications Consulting Engineers (AFCCE) also notes the potential problem between adjacent DTV and land mobile operations but concludes that "it is not clear that spurious components from the digital modulation can

¹⁹ *Id.* at Appendix B.

²⁰ *Id.* at 12.

²¹ Comments of UTC, the Telecommunications Association at 8, LMCC Comments at 12. See also, Comments of APCO at 17.

be reduced to the same degree [as NTSC emissions] because the out-of-band energy is greater than the analog case and the use of filters with high attenuation/sharp frequency roll-off characteristics introduce group delay problems which the digital modulator may not be able to adequately correct with pre-distortion techniques."²² AFCCE thus recommends that the FCC conduct further study on this issue but theorizes that a possible solution may be to limit the effective radiated power of DTV stations operating on adjacent channels to land mobile stations.²³

As discussed in the attached Appendix, the modified DTV allotment plan submitted with the Broadcast Coalition comments contains 14 instances in which the proposed DTV allotment is short spaced to adjacent channel land mobile operations. In addressing the use of channels 14-20, the Broadcast Coalition's proposed solution is to support "reallocation of land mobile channels in all markets" for the DTV transition.²⁴

²² Comments of the AFCCE at 12.

²³ Id. at 13. In addition, the AFCCE discusses a problem associated with replicating NTSC service areas out to the Grade B contour. The Grade B contour of some VHF frequencies reaches beyond the horizon which is impossible to replicate at UHF frequencies. Nonetheless, the FCC allotment methodology provides these DTV allotments with inordinate ERP's in an effort to duplicate VHF propagation results. The AFCCE recommends that the FCC attempt instead to replicate coverage to the Grade A contour and assume that Low Noise Amplifiers be required in the DTV television receivers (which will allow about a 10 dB reduction in the ERP required to replicate to the Grade B contour). Motorola strongly supports the AFCCE's recommendation as it should yield a more stable radio environment at UHF frequencies for all users. While we expect that Low Noise Amplifiers are technically feasible, we urge the FCC to acquire this additional information from television receiver manufacturers.

²⁴ Comments of Broadcast Coalition at 45.

The Coalition argues that recovering at least one channel in each market "particularly those channels that are lightly used" would improve DTV deployment options and "not impair land mobile operations." According to the Broadcasters, "a more efficient use of the spectrum is to make one of the two channels now allocated for land mobile use available solely to public safety services" adding cavalierly that "non-safety-related services should make use of the 800 MHz and 900 MHz bands."

Other broadcast interests offer different perspectives. Telemundo Group, Inc. objects to its proposed DTV allotment of channel 15 Corona, California because it would likely create interference to public safety land mobile operations on channels 14 and 16.²⁵ Telemundo continues to relate its experience with the adjacency issue noting that "it is almost impossible to prevent adjacent channel television stations from interfering with land mobile receivers" and that the resultant delays will impede its ability to compete in the DTV market.²⁶ Likewise, the comments of Chris Craft/United Group express concern of interference to land mobile operations on channel 20 in Philadelphia caused by its proposed DTV allotment of channel 19 in New York.²⁷ Chris Craft/United Group notes that channel 19 in Philadelphia is being "used by numerous private and public safety organizations from scores of sites throughout the state of New Jersey." The engineering

²⁵ Comments of Telemundo Group, Inc. at 4.

²⁶ Id.

²⁷ Comments of Chris Craft/United Group at 3.

report attached to these comments notes that "over half" of the land mobile licensees are "governmental and public safety organizations."

As discussed in the attached Appendix, Motorola has continued its analysis of the adjacent channel issues in reviewing the DTV allotment methodology. Motorola believes that case-by-case analysis and resolution pose the greatest opportunities to resolve this issue and looks forward to working with the broadcast community to find real world solutions. Motorola reiterates, however, that the burden must be imposed on broadcast stations to reduce emissions in the adjacent channel beyond that normally required. The FCC must take reasonable steps at the outset to minimize the area of interference and otherwise act to eliminate interference to incumbent land mobile systems.

Of course, the suggestion of the Broadcast Coalition to reallocate UHF-TV land mobile channels in all markets hardly deserves reply. The broadcasters apparently believe that adequate spectrum reserves exist in 11 of our most major markets to easily absorb the loss of at least 6 MHz of land mobile spectrum serving thousands of users. There is no excess spectrum in New York, Los Angeles, San Francisco or the other markets that have shared access to the UHF television band.²⁸ Finally, Motorola finds it odd that the Coalition speaks out on the efficient use of land mobile spectrum when it finds itself in the most advantageous position of each station receiving an additional 6

²⁸ See Note 2 *supra*

MHz of spectrum for a service that faces a multitude of competitors and who's viewership is down to 30 percent of its historical high.²⁹

V. CONCLUSION

In essence, the issue in this proceeding is whether the Commission adopts a spectrally efficient or a spectrally wasteful DTV allotment plan. Using the Commission's proposed draft plan as a basis, Motorola has developed an alternative plan which is more efficient with essentially no penalty to the broadcasters, compared to either the draft Commission or Broadcast Coalition plans.

Motorola's plan further minimizes allotments in TV channels 60-69, setting the stage for more meaningful recovery of excess broadcast spectrum. This in turn can have many benefits for the public, particularly as the Commission acts to meet the public safety spectrum needs documented in the PSWAC Final Report. In contrast, the Broadcast coalition plan unnecessarily loads up channels 60-69 with DTV allotments, apparently in an effort to stall spectrum recovery. Ironically, the Broadcast Coalition plan appears to be much less desirable for many broadcast licensees as it locates their DTV allotment in higher spectrum normally viewed as significantly less desirable for TV

²⁹ See Comments of the National Cable Television Association, Inc. at 7. Further, the Broadcast Coalition defends the importance of over-the-air television service in the face of direct competition from cable TV by stating that "the Commission must consider the one-third of U.S. television viewing households that do not subscribe to cable – these are viewers that depend exclusively on free over-the-air service." Motorola points out that, in 1997, U.S. television viewers actually have more program delivery options than noted by the broadcasters with the phenomenal success of direct broadcast satellite and the availability of terrestrial "wireless cable" service.

use. For these reasons, Motorola recommends the Commission absolutely minimize allotments in DTV channels 60-69, creating a win-win-win situation for public safety and other potential spectrum users, broadcasters and the public.

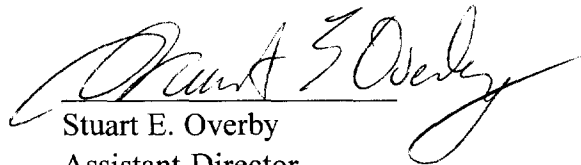
In addition, Motorola urges the Commission to protect land mobile operations on TV channels 14-20 from interference as the transition to DTV ensues. A portion of these channels provides spectrum that supports numerous public safety users, critical industries and small businesses in eleven urban areas.

Respectfully Submitted,

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ALLOTMENT PLAN COMPARISONS

APPENDIX

ALLOTMENT PLAN COMPARISONS